

CLAIMS

1. An optical filtering system comprising:

an optical separating sub-system;

said optical separating sub-system being capable of separating input optical radiation from at least one input beam/port into distinct input channels;

an optical recombining sub-system;

a selectable filtering sub-system including at least one switchable component, said selectable sub-system being interposed optically between said optical separating sub-system and said optical recombining sub-system; and,

said selectable filtering sub-system being capable of filtering said distinct input channels to effectuate said desired distinct output channels;

said optical recombining subsystem being capable of redirecting and recombining said desired distinct output channels for output.

2. The optical filtering system of claim 1 wherein said separating sub-system comprises a first separating diffraction grating, and a second separating diffraction grating; and,

wherein said recombining sub-system comprises a first recombining diffraction grating, and a second recombining diffraction grating.

3. The optical filtering system of claim 2 wherein said second separating diffraction grating comprises a switchable grating;

said first recombining diffraction grating comprises a switchable grating; and,

the selectable filtering sub-system comprises said second separating switchable grating, said first recombining switchable grating, said second separating switchable grating and said first recombining switchable grating being separated by free space.

4. The optical filtering system of claim 1 further comprising a directing/redirecting optical element capable of directing input optical radiation from said at least one input beam/port to a first diffraction grating from a pair of diffraction gratings, and capable of redirecting output optical radiation from said recombined output channels to said at least one output beam/port;

said pair of diffraction gratings constituting said separating sub-system for optical radiation received from the input beam/port and constituting said recombining sub-system for output channels received from the selectable filtering sub-system; and,

wherein the selectable filtering sub-system comprises a pixellated switchable transmissive element and a mirror.

5. The optical system of claim 1 wherein said separating sub-system comprises a first array waveguide grating (AWG); and,

wherein said recombining sub-system comprises a second array waveguide grating (AWG).

6. The optical filtering system of claim 1 wherein said at least one switchable component has a plurality of pixels, and the optical filtering system further comprises:

means operably connected to said selectable filtering sub-system for controlling a state of each of said pixels;

said controlling means being capable of enabling the selecting of desired distinct output channels.

7. An optical interleaving and/or band channelizing system comprising:

an optical separating sub-system;

said optical separating sub-system being capable of separating input optical radiation from at least one input beam/port into distinct input channels;

at least one redirecting optical sub-system comprising a pixellated redirecting optical component and a corresponding recombining optical component, said pixellated redirecting optical component and said corresponding recombining optical component being optically aligned with one another;

another optical sub-system comprising a redirecting element, and a recombining optical element, said redirecting element and said recombining optical element optically aligned with one another;

each said pixellated redirecting optical component being interposed optically between said optical separating sub-system and said another optical sub-system;

the pixellated redirecting optical component in said at least one redirecting optical sub-system being capable of redirecting a selected group of the distinct input channels towards the recombining optical component in said at least one redirecting optical sub-system and of transmitting a remainder of the distinct input channels, the recombining optical component said at least one redirecting optical sub-system being capable of recombining the selected group of the distinct input channels into at least one corresponding output beam; and,

the redirecting element in the another optical sub-system being capable of receiving at least a portion of the remainder of the distinct input channels, of redirecting said at least a portion of the remainder of the distinct input channels towards the recombining optical element, the recombining optical element being capable of recombining the at least a portion of the remainder of the distinct input channels into at least another output beam.

8. The optical interleaving and/or band channelizing system of claim 7 wherein said at least one pixellated redirecting optical component comprises a pixellated grating.
9. The optical system of claim 7 wherein at least one pixellated redirecting optical component comprises a pixellated mirror array.
10. The optical system of claim 7 wherein the separating sub-system comprises a first separating diffraction grating and a second separating diffraction grating.

11. The optical system of claim 7 wherein the separating sub-system comprises an array waveguide grating (AWG).
12. The optical system of claim 7 wherein the separating sub-system comprises a first separating diffraction grating and separating means for enhancing space uniformity.
13. The optical system of claim 12 wherein said separating means for enhancing space uniformity comprise at least two second separating diffraction gratings, each one of said at least two second separating diffraction grating capable of separating and redirecting a predetermined band of said distinct input channels.
14. An optical switching/routing system comprising:
  - a first optical sub-system comprising a separating optical component and separating means for enhancing space uniformity, said separating optical component and said separating means for enhancing space uniformity optically aligned with one another;
  - said first optical sub-system being capable of separating input optical radiation from at least one input beam/port into distinct input channels;
  - a second optical sub-system comprising recombining means for enhancing space uniformity and a recombining optical component, said recombining means for enhancing space uniformity and said recombining optical component optically aligned with one another;
  - a selectable switching/routing sub-system including at least one pixellated switchable component; said selectable switching/routing sub-system being optically interposed

between said first optical sub-system and said second optical sub-system;

said selectable switching/routing sub-system being capable of switching and routing said distinct input channels to desired distinct output channels; and,

said second optical subsystem being capable of redirecting and recombining said desired distinct output channels for output into at least one output beam/port.

15. The optical system of claim 14 wherein said separating means for enhancing space uniformity comprise at least two separating diffraction gratings, each one of said at least two separating diffraction grating capable of separating and redirecting a predetermined band of said distinct input channels; and,

said recombining means for enhancing space uniformity comprising at least two recombining diffraction gratings, each one of said at least two recombining diffraction gratings capable of redirecting and recombining the predetermined band of said distinct input channels.

16. The system of claim 15 wherein the first optical sub-system further comprises a first folding mirror; and  
wherein the second optical sub-system further comprises a second folding mirror.

17. The system of claim 14 further comprising;  
a first lens array interposed optically between said first optical sub-system and said selectable switching/routing sub-system; and,

a second lens array interposed optically between said selectable switching/routing sub-system and said second optical sub-system.

18. The optical system of claim 14 wherein said separating means for enhancing space uniformity comprise:

a first folding mirror,

at least two separating diffraction gratings,

and a first retro-reflecting mirror,

the first folding mirror capable of reflecting separated predetermined bands of said distinct input channels, at least one of said at least two second separating diffraction grating capable of separating and redirecting at least one of at least two predetermined bands of said distinct input channels, one of said at least two second separating diffraction gratings capable of separating a selected one of said predetermined bands of said distinct input channels and redirecting said selected band of distinct input channels towards the first retro-reflecting mirror; and

wherein said recombining means for enhancing space uniformity comprise ;

a second folding mirror,

at least two second recombining diffraction gratings,  
and,

a second retro-reflecting mirror,

at least one of said at least two second recombining diffraction grating capable of redirecting and recombining at least one of at least two predetermined bands of said distinct input channels, one of said at least two second recombining diffraction gratings capable of receiving a selected one of said predetermined bands of said distinct input channels and redirecting said

selected band of distinct input channels towards the second retro-reflecting mirror.

19. The optical system of claim 15 wherein said at least two second separating diffraction gratings comprise at least two second separating switchable diffraction gratings; and

wherein said at least two second recombining diffraction gratings comprise at least two second recombining switchable diffraction gratings; and, the selectable switching/routing sub-system comprises said at least two second separating switchable gratings, said at least two second recombining switchable gratings, and, free space propagation between said at least two second separating and said at least two second recombining gratings.

20. The optical system of claim 14 wherein said at least one switchable component has a plurality of pixels, and the optical system further comprises:

means operably connected to said selectable filtering sub-system for controlling a state of each of said pixels;

said controlling means being capable of enabling the selecting of desired distinct output channels.